Remarks

Entry of the amendments, reconsideration of the application, as amended, and allowance of all pending claims are respectfully requested. Claims 20, 38, 41 and 54 were amended for clarification purposes. Support for the claim amendments can be found throughout the specification (e.g., page 28), and thus, no new matter has been added. Claims 1-54 remain pending.

In accordance with 37 C.F.R. 1.121, a marked-up version of the specification and claims is provided on one or more pages separate from the amendment. These pages are appended at the end of the Response.

In the Office Action dated September 4, 2002, applicants received an indication that the attempt to incorporate subject matter into the application by reference to U.S. Patent No. 5,265,250 on page 16, line 9 is improper because the patent title does not match the patent number. Applicants have amended the specification to correct for a typographical error and now indicate that the patent number is 5,265,240, which does coincide with the patent title and issue date. Thus, applicants respectfully request withdrawal of the objection.

Claims 18 and 36 are objected to as being improper dependent form for failure to further limit the subject matter of a previous claim. Applicants respectfully submit that those claims do further limit the subject matter of a previous claim. For example, in independent claim 15, there is a claim element that recites obtaining data, without specifying the type of data. Claim 18, which is dependent on claim 15, further indicates that the data is measurement data usable in determining utilization of the one or more components of a channel. By indicating the type of data and what the data is used for, applicants respectfully submit that the claim does further limit the subject matter of the previous claim. Thus, applicants respectfully request withdrawal of the objection.

In addition to the above, claims 1-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Galbraith et al. (U.S. Patent No. 5,265,240) . Applicants respectfully, but most strenuously, traverse this rejection for the reasons below.

In one aspect, applicants' invention is directed to measuring the utilization of individual components of channels. That is, a channel has a plurality of individual components and one or more of those individual components are monitored and measured to determine the utilization of each particular component. This is advantageous because the modern channels, such as FICON channels, are able to multiplex many I/O operations at the same time, and can pipeline the execution of channel programs, and thus, measuring the utilization of individual components facilitates planning for those channels. Further details regarding a channel that has a plurality of components are described below.

Referring to FIG. 4 of applicants' specification, as one example, channel 116 includes a plurality of components, such as, for instance, a channel processor 408, an internal PCI bus 406 from the processor to the adapter, and an adapter card 410 (e.g., a fibre channel adapter). The channel processor is responsible for interpreting the channel command words and moving data to and from host memory to channel memory 400. The PCI bus moves instructions and data from channel processor storage 400 to adapter 410. The fibre channel adapter moves instructions and data from the PCI bus to the external fabric attached control units 412. Depending on the type of channel programs executed by the system, each of the three components of the channel may reach the limits of its capacity separately.

For example, small channel programs that include a few channel command words, but transfer a huge amount of data, will have very little use of channel processor 408, but will cause a very high utilization on internal PCI bus 406. However, a very long channel program that includes many channel command words, but only transfers very small amounts of data, require very high utilization of the channel processor, but little use of the internal PCI bus and fibre channel adapter. Thus, no single number can represent the channel utilization, since the components of the channel perform different tasks and can reach saturation at different points, depending on the nature of the I/O requests for the applications using the channel. Further, many

different applications can execute simultaneously on the channel, each with different characteristics and stressing different components of the channel at the same time. Therefore, in order for a customer to perform capacity planning and to correctly identify the resource of the channel that may be the bottleneck, each component is reported on separately. This allows the customer to identify the application's I/O characteristics that can be added without saturating the channel, or that can be removed to avoid saturations.

In one example (e.g., independent claim 1), applicants claim a method of determining utilization of channel components of a computing environment. The method includes, for instance, obtaining measurement data for a selected component of a channel, the channel comprising a plurality of components; and using the measurement data to determine utilization of that selected component. Thus, in applicants' claimed invention, a channel includes a plurality of components, and measurement data is provided for a selected one of those components. That measurement data is used to determine utilization of the selected component. This is very different from the teachings of Galbraith.

In Galbraith, there is no discussion of components of a channel. Instead, a channel is considered as one entity. This is explicitly stated throughout Galbraith. For instance, in the Abstract, it states, "Provides a method for measuring the busy utilization time for I/O channel used by any of plural operating systems (OSs) in a CEC." The utilization time is measured for the entire I/O channel. There is no discussion or suggestion of individual components of a channel or of measuring the individual components of a channel. This is simply missing. In particular, Galbraith only reports on the channel as a single component because channel busy was sufficient for understanding channel utilization in an environment where a channel could only do one thing at a time (e.g., for one command in the channel program at a time). However, now with channels that multiplex many operations and pipeline commands, channel busy time alone is no longer sufficient for understanding the channels' real capabilities and capacity. Thus, in accordance with applicants' claimed invention, measurements are taken for individual components of channels, unlike in Galbraith.

In support of the rejection, the Office Action references Col. 3, first paragraph, to indicate that it is known to measure each channel component's connecting time. Applicants respectfully disagree. A careful reading of that paragraph indicates that the reference describes measuring the accumulation of the duration of connect time for each I/O device. Thus, it is measuring connect time for I/O devices. However, an I/O device is not a component of a channel. That is, an I/O device is not part of the channel, but instead is coupled to a channel. Thus, there is no teaching or suggestion of measuring individual components of a channel.

Additionally, the next paragraph in Column 3 indicates that device level channel measurement does not provide individual utilization measurements for each of the plurality of channels to which a device may be configured. Thus, even if a device was considered a part of a channel, which is not being conceded by applicants, the reference still indicates that those measurements do not provide individual utilization measurements. Instead, the teaching of the reference indicates that the total device connect time over all the channels to the device is represented. Again, there is no teaching or suggestion of measuring individual components of a channel, as claimed by applicants.

Further, when multiplexing many I/O operations at a time, connect time for any individual device is a meaningless indicator. All the devices remain connected, while they execute the channel program because of multiplexing. The more operations that are multiplexed, the longer connect time will grow for each individual operation, because as the data and commands are interleaved more and more, each individual execution time grows. It means nothing as an indication of channel utilization.

Based on the foregoing, applicants respectfully submit that Galbraith fails to teach or suggest a channel having a plurality of components. As a further example, Galbraith fails to teach or suggest reporting measurements on individual components of the channel, as claimed by applicants. Thus, applicants respectfully submit that claim 1, as well as claims 21, 39 and 42 are patentable over Galbraith. The claims dependent therefrom are also patentable for similar reasons, as well as for their own additional features. Similarly, claims 15, 33, 40 and 50, and those dependent thereon, are patentable for the reasons described above.

In addition to the above, claims 20, 38, 41 and 54 are patentable over Galbraith et al. For instance, in independent claim 20, a method of determining utilization of channels of a computing environment is recited. The computing environment includes a plurality of logical partitions and the method includes, for instance, obtaining on behalf of a logical partition involved in determining utilization of a channel, measurement data for the channel. The measurement data is representative of use of the channel by the logical partition and representative of use by one or more other logical partitions of the plurality of logical partitions. That measurement data is then used to determine utilization of the channel. Thus, in applicants' claimed invention, the measurement data obtained for a particular logical partition is measurement data representative of a plurality of logical partitions (e.g., the logical partition involved in determining the utilization, as well as one or more other logical partitions). This is very different from the teachings of Galbraith.

Although Galbraith teaches a plurality of logical partitions, Galbraith does not teach or suggest that measurement data obtained for a particular logical partition is representative of multiple logical partitions. Instead, in Galbraith, the measurement data for each logical partition is exclusively for that logical partition. This is explicitly stated in Galbraith. For example, in Col. 2, lines 12-14, it is stated: "The two OSs must be provided measurements which do not indicate the other OSs use of the shared I/O resource." Therefore, the measurements provided are for a single operation system (i.e., a single logical partition), and not for multiple logical partitions, as claimed by applicants. Thus, claims 20, 38, 41 and 54 are patentable over Galbraith.

Based on the foregoing, applicants respectfully request indication of allowability for all pending claims.

Should the Examiner wish to discuss this case with applicants' attorney, please contact applicants' attorney at the below listed number.

Respectfully submitted,

Blanche E. Schiller

Blanche E. Schiller
Attorney for Applicants
Registration No. 35,670

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HESLIN ROTHENBERG FARLEY & MESITI P.C.
5 Columbia Circle
Albany, New York 12203
Telephone: (518) 452-5600
Facsimile: (518) 452-5579

Version with markings to show changes made

In the Specification:

On page 16, paragraph 1, lines 5-12, have been amended, as follows:

Channel subsystems are further described in Casper et al., U.S. Patent No. 5,526,484, entitled "Method and System for Pipelining the Processing of Channel Command Words," issued on June 11, 1996, as well as in Galbraith et al., U.S. Patent No. [5,265,250] 5,265,240, entitled "Channel Measurement Method and Means," issued on November 23, 1993, each of which is hereby incorporated herein by reference in its entirety.

In the Claims:

Claims 20, 38, 41 and 54 have been amended, as follows:

20. (AMENDED) A method of determining utilization of channels of a computing environment, said computing environment comprising a plurality of logical partitions, and said method comprising:

obtaining, on behalf of a logical partition involved in determining utilization of a channel, measurement data for [a] the channel, said measurement data being representative of use of said channel by [a] the logical partition [involved in determining the utilization] and representative of use by one or more other logical partitions of said plurality of logical partitions; and

using said measurement data to determine utilization of the channel.

38. (AMENDED) A system of determining utilization of channels of a computing environment, said computing environment comprising a plurality of logical partitions, and said system comprising:

means for obtaining, on behalf of a logical partition involved in determining utilization of a channel, measurement data for [a] the channel, said measurement data being representative of use of said channel by [a] the logical partition [involved in determining the utilization] and representative of use by one or more other logical partitions of said plurality of logical partitions; and

means for using said measurement data to determine utilization of the channel.

41. (AMENDED) A system of determining utilization of channels of a computing environment, said computing environment comprising a plurality of logical partitions, and said system comprising:

at least one processor adapted to obtain, on behalf of a logical partition involved in determining utilization of a channel, measurement data for [a] the channel, said measurement data being representative of use of said channel by [a] the logical partition [involved in determining the utilization] and representative of use by one or more other logical partitions of said plurality of logical partitions; and

at least one processor adapted to use said measurement data to determine utilization of the channel.

54. (AMENDED) At least one program storage device readable by a machine, tangibly embodying at least one program of instructions executable by the machine to perform a method of determining utilization of channels of a computing environment, said computing environment comprising a plurality of logical partitions, and said method comprising:

obtaining, on behalf of a logical partition involved in determining utilization of a channel, measurement data for [a] the channel, said measurement data being representative of use of said channel by [a] the logical partition [involved in determining

the utilization] and representative of use by one or more other logical partitions of said plurality of logical partitions; and

using said measurement data to determine utilization of the channel.